

5. SITE CHARACTERISTICS

5.1 Physical Characteristics

The INEEL is located on the Eastern Snake River Plain, a large topographic depression extending from the Oregon border across Idaho to Yellowstone National Park and northwestern Wyoming. The surface of the INEEL, in general, is covered by basalt flows and intermittent, discontinuous pockets of sediment.

Surface hydrology includes water from three streams that flow intermittently onto INEEL and local runoff caused by precipitation and melting snow. No ponds and streams are within WAG 4 except very briefly in conjunction with spring runoff. The Big Lost River is the nearest surface water feature and is not influenced by activities at WAG 4.

The vadose zone is the unsaturated region extending from land surface down to the water table, and varies in thickness from approximately 61 m (200 ft) thick in the northern part of INEEL to more than 274 m (900 ft) in southern portions of the Site (Irving 1993). The vadose zone is a complex series of heterogeneous basalt flows with thin layers of interbedded sediments. The basalt flows consist of thick dense intervals as well as large void spaces resulting from rubble zones, lava tubes, undulatory basalt-flow surfaces, and fractures. Sediment interbeds in the vadose zone consist of sand, silt, and clay and are generally thin and discontinuous. The vadose zone is approximately 146 m (480 ft) thick beneath CFA.

The Snake River Plain Aquifer (SRPA) underlies most of INEEL. The aquifer, defined as the saturated region beneath the vadose zone, arcs approximately 325 km (200 mi) through the eastern Idaho subsurface and varies in width from approximately 80 to 112 km (50 to 70 mi). The total area is about 25,000 km² (9,600 mi²). The SRPA discharges approximately 8.8E+09 m³ (7.1 million acre/ft) of water annually to springs and rivers (EG&G 1993). The aquifer contains thick sequences of numerous, relatively thin basalt flows extending to depths of 1,067 m (3,500 ft) below ground surface (bgs). The SRPA also contains sediment interbeds within the basalt flows that are typically discontinuous. The aquifer has an estimated capacity of 2.5E+12 m³ (8.8E+13 ft³) of water (EG&G 1986).

The SRPA is recharged primarily by infiltration from precipitation and deep percolation of irrigation water. Regional groundwater flows to the south-southwest; however, the flow direction can be affected locally by recharge from rivers, surface water spreading areas, and heterogeneity in the aquifer. Locally at CFA, the groundwater flow direction is to the south. Estimates of flow velocities within the aquifer range from 1.5 to 6.1 m/day (5 to 20 ft/day) (EG&G 1993). Flow in the aquifer is primarily through fractures, through interflow zones in the basalt, and in the highly permeable rubble zones located at the top of basalt flows. The aquifer is considered heterogeneous and anisotropic (having properties that differ depending on the direction of measurement) because of the permeability variations within the aquifer that are caused by basalt irregularities, fractures, void spaces, rubble zones, and sediment interbeds. The heterogeneity of the basalt bedrock results in a high variability in transmissivity values (measures of the ability of the aquifer to transmit water). Transmissivity measurements in wells on the INEEL range from 1.0E-01 to 1.1E+06 m²/day (1.1E+00 to 1.2E+07 ft²/day) (INEEL 1995a). Concerns about groundwater contamination from INEEL operations have prompted an extensive monitoring system over all of INEEL (EG&G 1993).

5.2 Climate

Meteorological and climatological data for the INEEL and the surrounding region are collected and compiled from several meteorological stations and three stations that are located at INEEL operated by the National Oceanic and Atmospheric Administration field office in Idaho Falls, Idaho.

The region is classified as arid to semiarid (DOE-ID 1989) with an annual average precipitation of 22.1 cm (8.7 in.). The rates of precipitation are highest during the months of May and June and lowest during July. Normal winter snowfall occurs from November through April, though occasional snowstorms occur in May, June, and October. Snowfall at the INEEL ranges from about 17.3 cm (6.8 in.) per year to about 151.6 cm (59.7 in.) per year, and the annual average is 70.1 cm (27.6 in.) (DOE-ID 1989). The INEEL is subject to severe weather episodes throughout the year. Thunderstorms are observed mostly during spring and summer. An average of two to three thunderstorms occurs during each month from June through August (EG&G 1981). Thunderstorms are often accompanied by strong gusty winds that may produce local dust storms. Precipitation from thunderstorms at INEEL is generally light. Occasionally, however, rain resulting from a single thunderstorm on INEEL exceeds the average monthly total precipitation (EG&G 1984).

The average summer daytime maximum temperature is 28°C (83°F), while the average winter daytime maximum temperature is -0.6°C (31°F). Recorded temperature extremes at the INEEL vary from a low of -44°C (-47°F) in January to a high of 38°C (101°F) in July (DOE-ID 1989). The relative humidity at INEEL ranges from a monthly average minimum of 18% during the summer months to a monthly average maximum of 55% during the winter. The relative humidity is directly related to diurnal temperature fluctuations. Relative humidity reaches a maximum just before sunrise (the time of lowest daily temperature) and a minimum in midafternoon (the time of maximum daily temperature) (DOE-ID 1989).

The INEEL is in the belt of prevailing westerly winds, which are channeled within the Eastern Snake River Plain to produce a west-southwest or southwest wind approximately 40% of the time. The average midspring windspeed recorded at a height of 6 m (20 ft) is 9.3 mph, while the average midwinter windspeed is 5.1 mph (EG&G 1993).

5.3 Flora and Fauna

Six broad vegetation categories representing nearly 20 distinct habitats have been identified on the INEEL: (1) juniper-woodland, (2) native grassland, (3) shrub-steppe off lava, (4) shrub-steppe on lava, (5) modified, and (6) wetlands. Though small riparian and wetland regions exist along the Big Lost River and Birch Creek, nearly 90% of the site is covered by shrub-steppe vegetation. The most common varieties are big sagebrush, saltbush, rabbitbrush, and native grasses.

The INEEL serves as a wildlife refuge because a large percentage of the Site is undeveloped and human access is restricted. Grazing and hunting are prohibited in the central part of the site. Mostly undeveloped, this tract may be the largest relatively undisturbed sagebrush steppe in the Intermountain West outside of the national parklands (DOE-ID 1996). More than 270 vertebrate species including 43 mammalian, 210 avian, 11 reptilian, nine fish, and two amphibious species have been observed on the site. Hundreds of birds of prey and thousands of pronghorn antelope and sage grouse have often wintered on INEEL. Mule deer and elk also reside at the Site. Observed predators include: bobcats, mountain lions, badgers, and coyotes. Bald eagles, classified as a threatened species, are commonly observed on or near the site each winter. Peregrine falcons, which are classified as endangered, have also been observed. In addition, other species that are candidates for listing as threatened or endangered by the U.S. Fish and

Wildlife Service may either inhabit or migrate through the area. Candidate species that may frequent the area include ferruginous hawks, pygmy rabbits, Townsend's big-eared bats, burrowing owls, and loggerhead shrikes.

The flora and fauna existing around CFA are representative of those found across the INEEL (Arthur et al. 1984; Reynolds et al. 1986). Wildlife species present in and around the CFA include birds, mammals, and reptiles that are associated with facilities, sagebrush-rabbitbrush, grasslands, and disturbed habitats, deciduous trees and shrubs, and water (e.g., facility ponds and drainage areas). Both aquatic and terrestrial species are potentially present. Sagebrush habitats in areas adjacent to facilities support a number of species including sage grouse and pronghorn antelope (game species) and areas of grassland provide habitat for species such as the western meadowlark (*Sturnella neglecta*) and mule deer (*Odocoileus hemionus*), also a game species. Buildings, lawns, ornamental vegetation, and disposal/drainage ponds at WAG 4 are also used by a number of species such as waterfowl, raptors, rabbits, mule deer, and bats. No areas of critical habitat as defined in the 40 CFR Part 300 are known to exist in or around CFA.

5.4 Demography

The human populations potentially affected by INEEL activities include INEEL employees, ranchers who graze livestock in areas on or near the INEEL, hunters on or near the site, residential populations in neighboring communities, and highway travelers.

Nine separate facilities at INEEL, Figure 1-1, include approximately 450 buildings and more than 2,000 other support facilities. Presently, the INEEL employs 8,348 contractor and government personnel. Employee totals at INEEL locations include 250 at the Waste Management Facility; 1,049 at the CFA; 433 at Test Area North; 511 at the Test Reactor Area; 622 at the Naval Reactors Facility; 1,201 at the Idaho Nuclear Technology and Engineering Center; 732 at Argonne National Laboratory-West; and 193 within the remaining site-wide areas, which include the Auxiliary Reactor Area. Approximately 3,231 INEEL employees occupy numerous offices, research laboratories, and support facilities in Idaho Falls.

The INEEL is bordered by five counties: (1) Bingham, (2) Bonneville, (3) Butte, (4) Clark, and (5) Jefferson (see Figure 5-1). The nearest communities to INEEL are Atomic City, located south of the INEEL border on U.S. Highway 26; Arco, 11 km (7 mi) west of INEEL; Howe, west of INEEL on U.S. Highway 22/33; and Mud Lake and Terreton on the northeast border of INEEL. Other communities located near the INEEL include Blackfoot and Shelley in Bingham County; Idaho Falls and Ammon in Bonneville County; Arco in Butte County; and Rigby in Jefferson County.

5.5 Cultural Resources

Over the past two decades, detailed inventories of cultural resources at some parts of the INEEL have been assembled. Initial surveys have been focused on areas within and around major operating facilities at the Site. Proposed future construction areas also have been examined. As of January 1, 1998, approximately 6.6% (37,681 acres) of the 2,305 km² (890 mi²) comprising the INEEL has been systematically surveyed for archaeological resources and 1,839 archaeological localities have been identified. The inventory includes prehistoric resources representing a span of approximately 12,000 years, as well as historic resources representing the last 150 years. Cultural resources on INEEL also include a number of more recent buildings, structures, and objects that have made significant contributions to the broad patterns of American history through the Site's association with World War II,

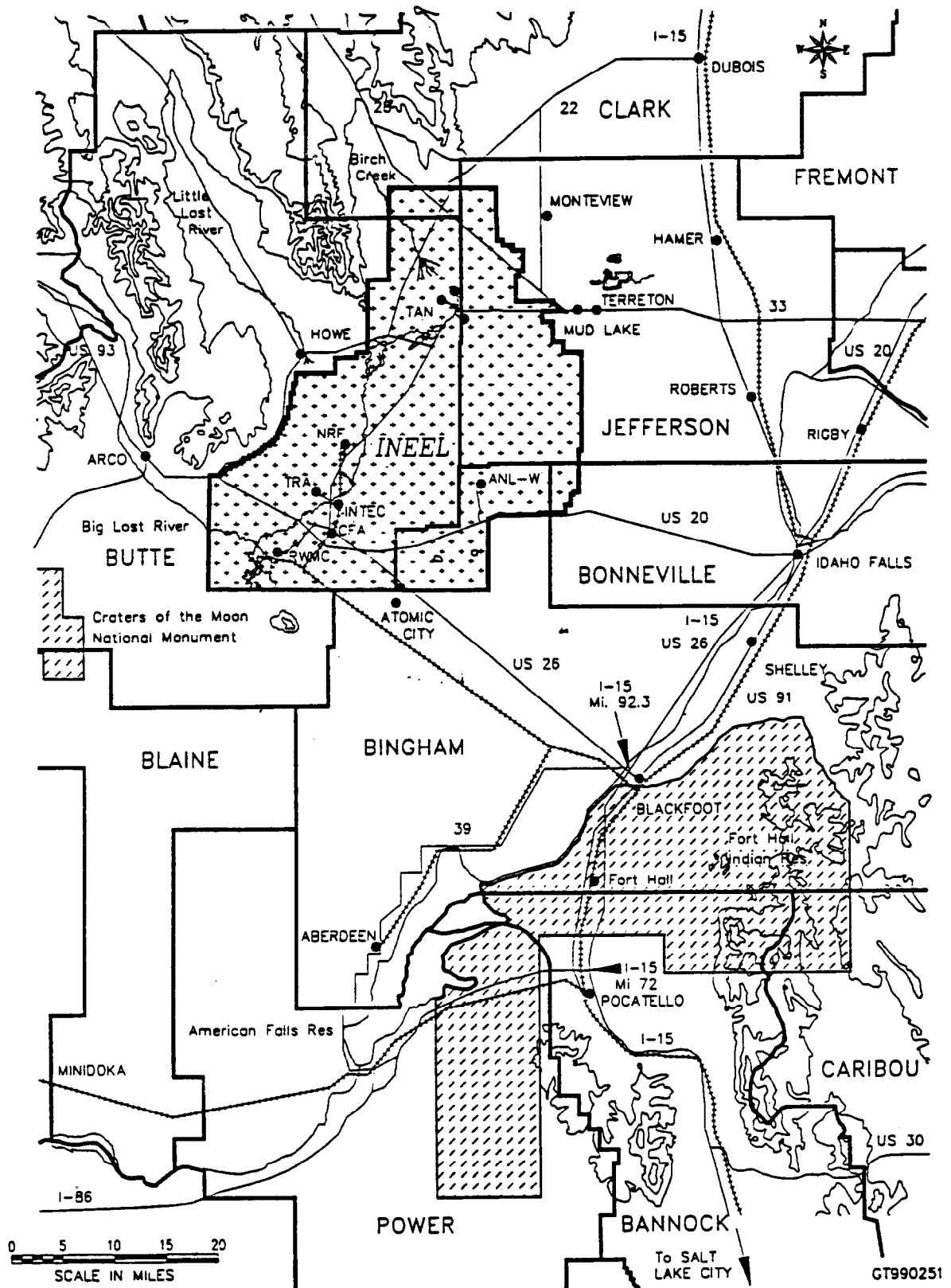


Figure 5-1. Counties surrounding the INEEL.

the Cold War, and important advances in nuclear science and technology. One INEEL facility, Experimental Breeder Reactor I, is recognized as a national historic landmark.

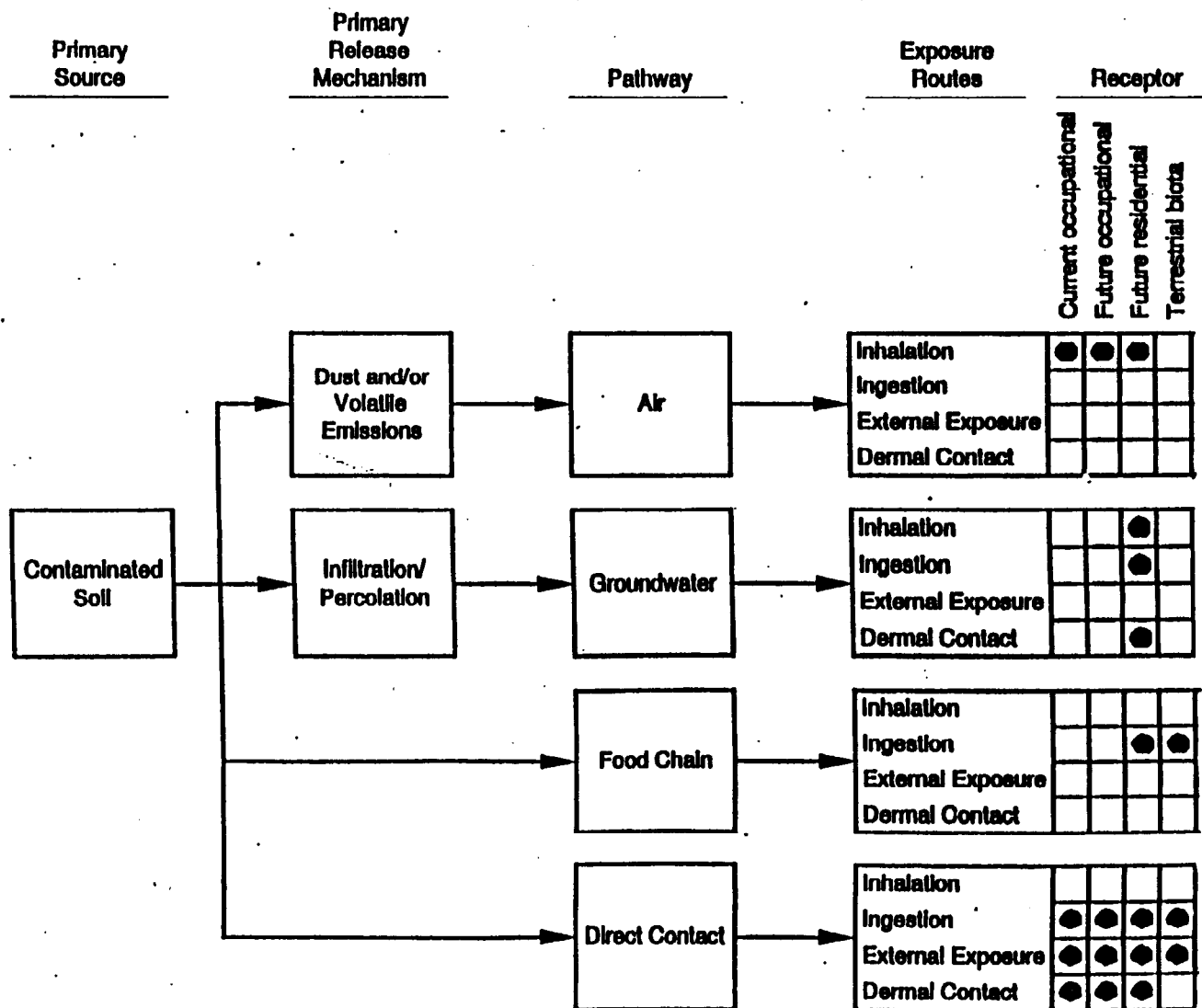
Local Native American people, particularly the Shoshone-Bannock tribal members of Fort Hall, Idaho, view all of the prehistoric sites on the INEEL as ancestral and of traditional cultural significance. A variety of natural features are also important to Native Americans. Native American burial sites, though rare, are of special concern on INEEL.

5.6 Conceptual Site Models

The conceptual site models used in the OU 4-13 Comprehensive RI/FS to evaluate potential risk from surface soil, underground storage tanks and buried waste, and liquid discharge are shown in Figures 5-2 through 5-4. The models illustrate hypothetical exposure routes to current and future workers, future residents, and ecological receptors. Future occupational and residential scenarios are assumed to begin in 100 years. The models are based on land-use assumptions and the exposure assessment conducted for the OU 4-13 RI/FS. The human health conceptual site models (Figures 5-2 through 5-4) are based on the following land use assumptions:

- The INEEL will remain under government ownership and institutional control for at least the next 100 years (i.e., until the year 2095, 100 years from the date the INEEL land-use projections were established [DOE-ID 1996]).
- No residential development will occur within the INEEL boundaries within the institutional control period.

The complete conceptual site model for the ecological risk assessment (Figure 5-5) reflects the locations of contaminated media to which ecological receptors may be exposed. For a more detailed conceptual site model, see Section 7 of the OU 4-13 Comprehensive RI/FS (DOE-ID 1999a).



GA00 1237

Figure 5-2. Conceptual site model for contaminated soil sites at CFA.

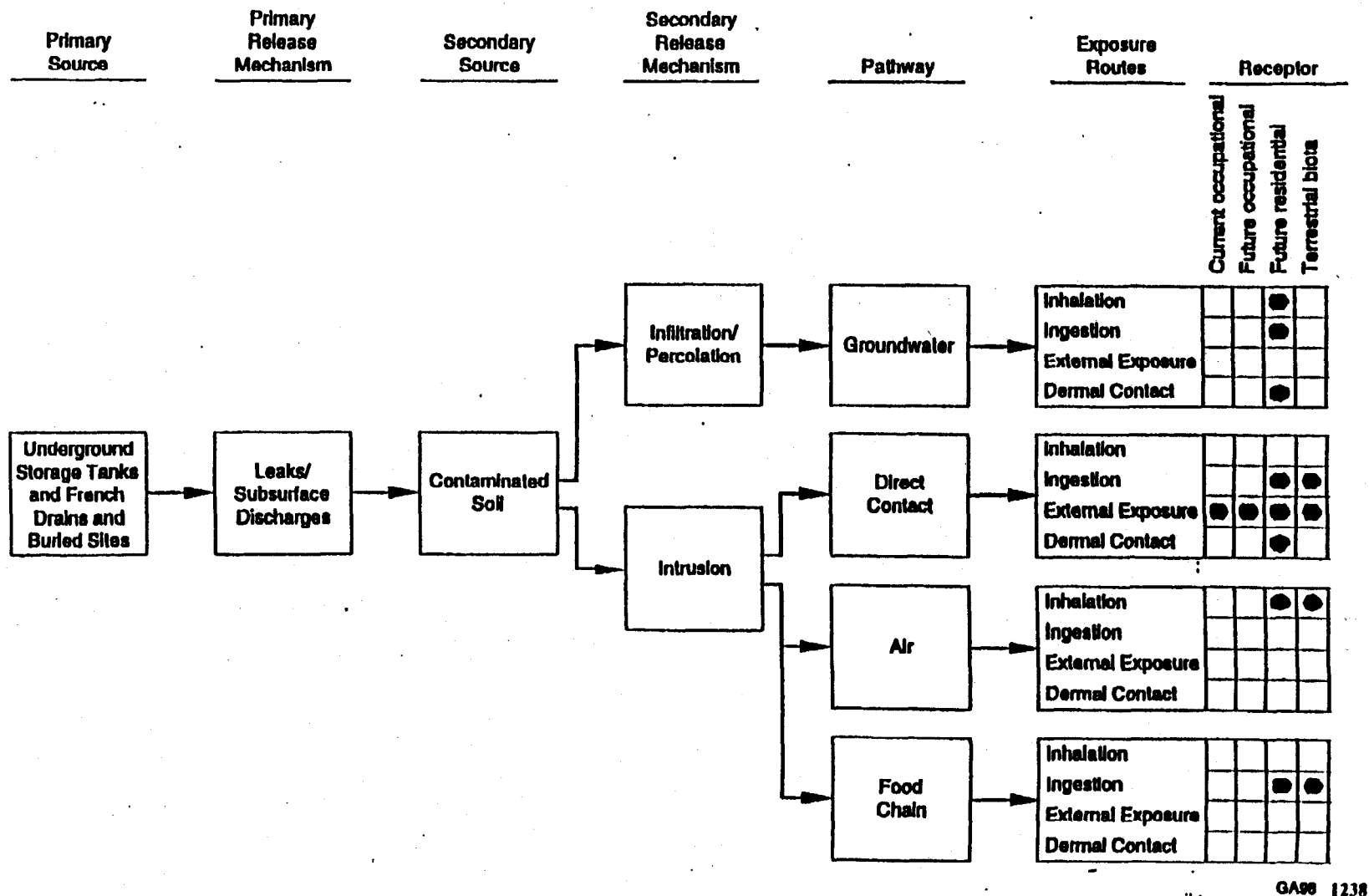
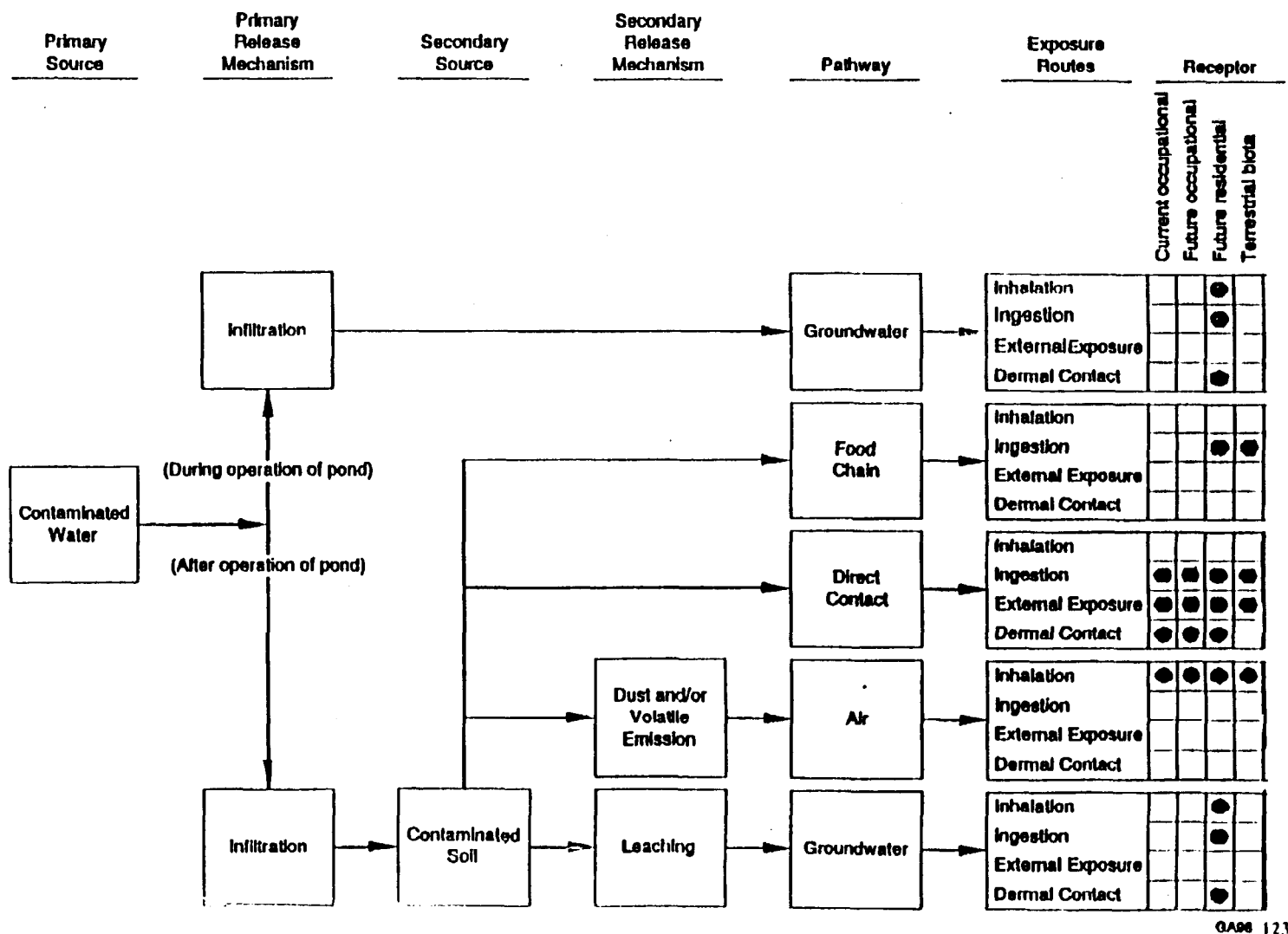


Figure 5-3. Conceptual site model for underground storage tanks and buried waste sites at CFA.



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Figure 5-4. Conceptual site model for liquid discharge sites at CFA.

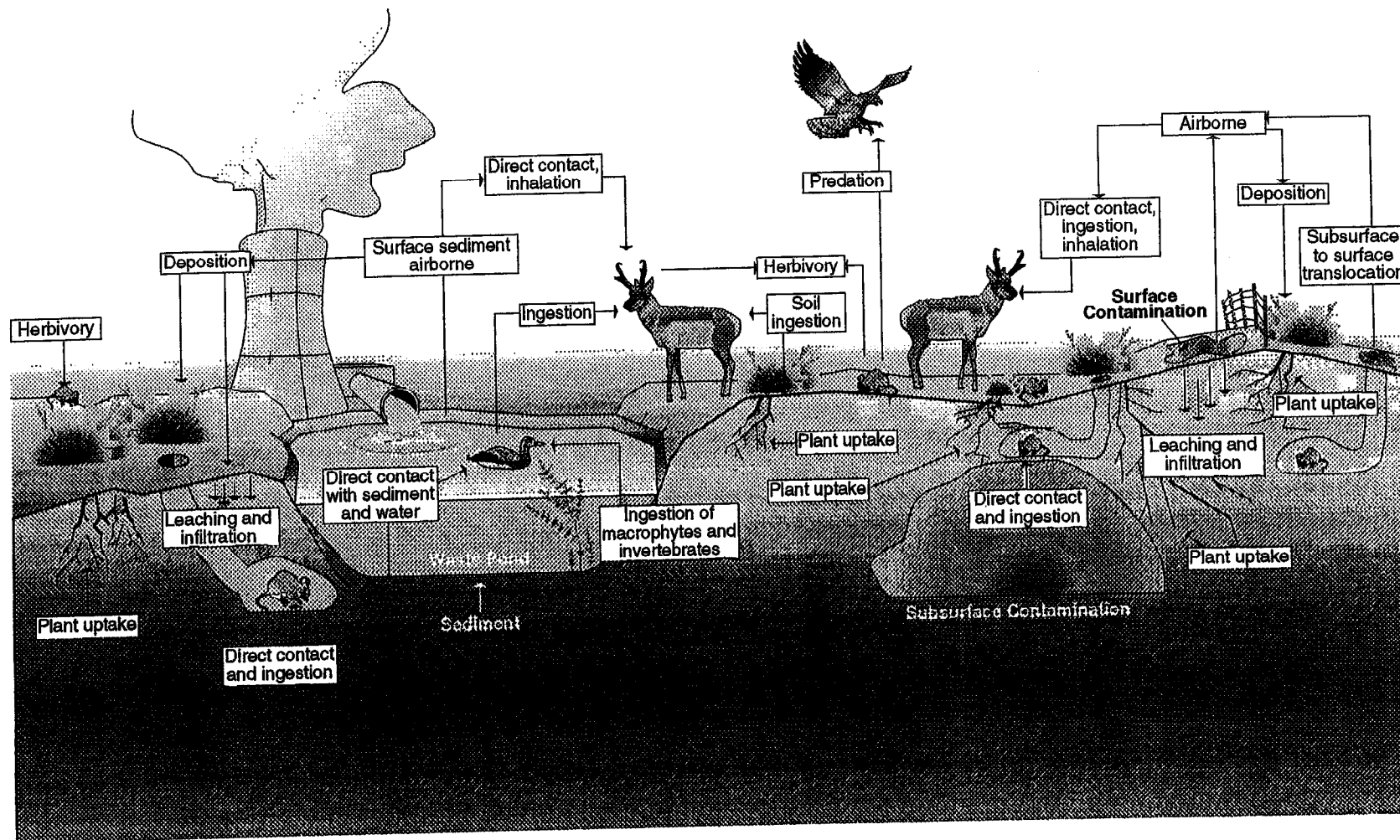


Figure 5-5. Complete conceptual site model for ecological receptors at WAG 4.

6. CURRENT AND POTENTIAL SITE AND RESOURCE USES

The INEEL has an area of approximately 2,305 km² (890 mi²) or (230,266 ha [569,000 acres]). Approximately 98% of this land, has not been impacted by INEEL operations. The land use at the INEEL was evaluated in the Comprehensive Facility and Land Use Plan (CFLUP) (DOE-ID 1996). Land use on the entire INEEL is restricted. Though public highways traverse the INEEL, public access beyond the highway right-of-way is not allowed. Access to facilities requires proper clearance, training, or escort. There are specific controls in place to limit exposure to sites. Current and projected land use as described in the report is summarized below.

6.1 Current Land Use

The land within INEEL is classified as industrial or mixed use by the U. S. Bureau of Land Management (BLM) (DOE-ID 1996). The INEEL land use consists of wildlife management, government industrial operations, and waste management. As shown in Figure 6-1, large tracts of land are reserved as buffer and safety zones around the boundary of the INEEL. Operations are generally restricted to the INEEL proper. Aside from the operational facilities, the land within INEEL proper is largely undeveloped and used for environmental research, ecological preservation, and sociocultural preservation. No residential areas are located within the INEEL boundaries.









The buffer surrounding INEEL consists of 1,295 km² (500 mi²) of grazing land (DOE-ID 1996) administered by the BLM. Grazing areas around the INEEL support cattle and sheep, especially during dry conditions. Controlled hunts of game animals managed by the Idaho Department of Fish and Game are permitted on INEEL and within the buffer zone during selected years (DOE-ID 1996). Hunters are allowed access to an area that extends 0.8 km (0.5 mi) inside INEEL boundary on portions of the northeastern and western borders of INEEL (DOE-ID 1996).

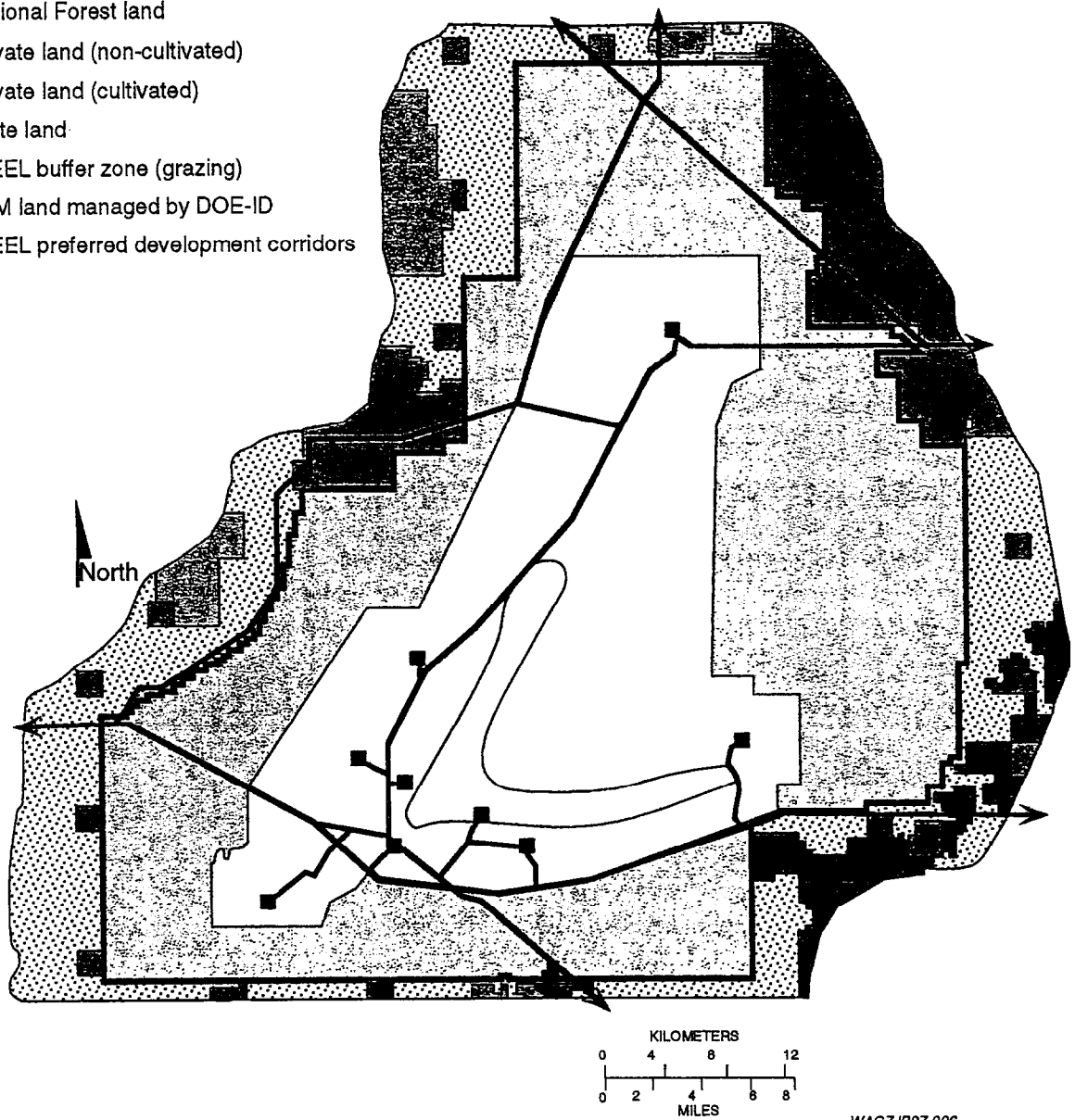
State Highways 22, 28, and 33 cross the northeastern portion of the Site. U.S. Highways 20 and 26 cross the southern portion (Figure 1-1). As much as 145 km (90 mi) of paved highways used by the general public and 23 km (14 mi) of Union Pacific Railroad tracks traverse the southern portion of the Site (DOE-ID 1996). A government-owned railroad passes from the Union Pacific Railroad at the CFA to the Naval Reactors Facility. An additional spur runs from the Union Pacific Railroad to the Radioactive Waste Management Complex.

In the counties surrounding the INEEL, approximately 45% of the land is used for agriculture, 45% is open land, and 10% is urban (DOE-ID 1996). Land use includes grazing, livestock production, and dairy farming (EG&G 1984). Major crops produced on land surrounding INEEL are wheat, alfalfa, barley, potatoes, oats, and corn. Sugar beets are grown within 64 km (40 mi) of INEEL in the vicinity of Rockford, Idaho. The land surrounding the INEEL is owned by either private individuals or the U.S. Government. The BLM administers the government land on INEEL (DOE-ID 1996).

6.2 Future Land Use

The future land use within the INEEL is projected to remain essentially the same as the current use: research facilities within the INEEL boundaries, agriculture, and open land surrounding the INEEL (Figure 6-1). The CFLUP was developed using a stakeholder process that involved a public participation forum, a public comment period, and the INEEL CAB. The public participation forum included members from local counties and cities, Shoshone-Bannock Tribes, BLM, DOE, U.S. Forest Service, U.S. National Park Service, Idaho Department of Transportation, Idaho Fish and Game, and eight businesses, education,

-  Bureau of Land Management (grazing)
-  National Forest land
-  Private land (non-cultivated)
-  Private land (cultivated)
-  State land
-  INEEL buffer zone (grazing)
-  BLM land managed by DOE-ID
-  INEEL preferred development corridors



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Figure 6-1. Land ownership distribution in the vicinity of the INEEL and on-INEEL areas open for permitted grazing.

and citizen organizations. EPA and IDHW participated in an ex officio capacity. Following review and comment by the public participation forum, the CFLUP underwent a 30-day public comment period and was subsequently submitted to the INEEL CAB for review and recommendations. No recommendations for residential use of any portions of the INEEL within the next 100 years have been received to date.

Land use projections are based on the following assumptions and factors:

- The INEEL will remain under government management and institutional control for at least the next 100 years
- DOE projections for the future of its national laboratory research and development activities and nuclear reactor programs
- The presence of active industrial and research facilities
- The presence of an industrial infrastructure
- The likely inability to "green field" (e.g., return to natural state with unrestricted land-use) the industrial complex without total removal of waste
- No nonindustrial land use within the INEEL, other than grazing
- Recommendations from the INEEL CAB and other stakeholders about future use assumptions.

Land use on the INEEL is anticipated to include unrestricted industrial uses, government-controlled industrial uses, unrestricted areas, controlled areas for wildlife management and conservation, and waste management areas. No residential development will be allowed within the INEEL boundaries, and no new major private developments (residential or nonresidential) on public lands are expected in areas adjacent to the Site. Grazing will be allowed to continue in the buffer area (DOE-ID 1996).

Regardless of the future use of the land now occupied by the INEEL, the federal government has an obligation to provide adequate institutional controls (i.e., limited access) to areas that pose significant health or safety risks until those risks diminish to acceptable levels (see Section 12.2). Fulfillment of this obligation is contingent on the continued viability of the federal government and on congress appropriating sufficient funds to maintain the institutional controls for as long as necessary.

6.3 Groundwater Use

Current use of SRPA groundwater at CFA is for drinking and irrigation. Groundwater is extracted from two production wells at CFA (CFA-1 and CFA-2). A drinking water program was initiated in 1988 to monitor drinking water wells on the INEEL for compliance with drinking water system standards as established by EPA, the State of Idaho, and applicable DOE orders.

6.4 Groundwater Classification and Basis

The eastern portion of the aquifer was granted sole source status by the EPA on October 7, 1991 (56 FR 50634). The definition of a sole source aquifer is that more than 50% of the people who live above the water use it for beneficial use. Idaho water quality standards are dictated primarily by the

recently promulgated Idaho Groundwater Quality Rule and the Idaho Water Quality Standards and Wastewater Treatment Requirements. The National Primary Drinking Water Regulations can also apply.(IDAPA 16.01)

Three categories of protectiveness apply to the aquifer and its associated resources under Idaho regulations: (1) Sensitive Resources; (2) General Resources; and (3) Other Resources. Because no previous action to categorize the SRPA under Idaho regulations has occurred, the aquifer defaults to the "General Resources" category. General Resource aquifers are protected to ensure that groundwater quality is not jeopardized. Idaho's groundwater standards incorporate federal radiation exposure and drinking water standards (10 CFR 20, 1999, Appendix B, Table 2; 40 CFR 141, 1998; and 143, 1998).